



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: ICE CONFECTIONS		
<p>(57) Abstract</p> <p>A two component ice confection is formed by cooling an ice confection core to below -15 °C, preferably using a cryogenic liquid, then immersing it in a water ice solution to form a layer of water ice on the core, and then hardening the water ice layer. Products formed by the process preferably have an average ice crystal size of below 100 micron.</p>		

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ICE CONFECTIONS5 FIELD OF THE INVENTION

10 This invention relates to ice confections which comprise a mass of a milk containing frozen confection, for example ice cream, with a surface covering of water ice. Products of this form are usually referred to as "splits" and this term will be used. This product form provides two refreshing ice compositions within a single body.

15 BACKGROUND TO THE INVENTION

20 Splits are usually sold with an ice cream core, as an example of a milk based frozen confection, with a stick for holding the product and an outer layer of water ice. However, they are not limited to this geometry and may be in other shapes, e.g. spherical, and can be in a container for consumption. For example an ice cream could be produced in a standard tub with a layer of water ice on top. The term "split" is used herein to be a mass of ice confection having a layer of water ice in contact with it.

25 The milk containing frozen confection contains milk proteins and the class includes ice cream, frozen yoghurt, sherbet, sorbet, ice milk and frozen custards. The usual form of protein will be animal milk but vegetable sources, e.g. soya milk, are also usable. There is no criticality in the source of the milk protein and it may be incorporated as liquid milk, cream, skimmed milk, milk powder and skimmed milk powder, as examples.

35 One known method of manufacturing split products is to partially freeze a water ice composition in the form of a cylinder closed at one end and then fill the centre core

with liquid ice cream composition. Typically the water ice solution is placed in a cone in a freezing bath. The cone is inverted when the water ice contacting the cone wall is frozen and then an ice confection placed in the core. A stick for hand holding is placed in the core.

The manufacture of a two component ice confection by this route requires careful manipulation of the feedstocks and the several stages of handling. There is usually a restriction in the product geometry which can be obtained. The levels of overrun in the ice confection are limited because at higher levels the ice confection is more viscous.

#### LITERATURE

Ice confections have been well characterised in the literature and general disclosures will be found in "Ice Cream" by W S Arbuckle (published by AVI of Westport, Conn USA) in 4 editions and J Soc Dairy Technology 1990, 43(1), pp 17-20.

#### GENERAL DESCRIPTION OF THE INVENTION

The invention provides a method of preparing a two component ice confection in which (i) a surface of a mass of milk containing ice confection is brought to a temperature of below about  $-15^{\circ}\text{C}$ , preferably below about  $-25^{\circ}\text{C}$  and more preferably below about  $-40^{\circ}\text{C}$ , (ii) the surface is contacted with a water ice solution having a solids content between about 15% and about 50% by weight for a time sufficient to allow a layer of water ice to form on the surface and (iii) the whole is subjected to a hardening step to form the water ice layer. This step is performed at the temperature of step (i) or preferably below. Water ice forms during the pick up but the layer is completed in the hardening step.

Preferably the two component ice confection formed by this process comprises a mass of milk containing ice confection having a water ice on at least one surface having an average ice crystal size ( $D_{(3,0)}$ ) below 100 micron more preferably below 80 micron. This method provides a water ice layer which has consistent texture and can have a range of thickness. The low temperature of the ice confection core can be obtained in a refrigerated volume, for example a blast cooler, or preferably by immersion in a cryogenic liquid, e.g. liquid nitrogen.

The product of this invention comprises two essential components, the ice confection mass and the water ice layer. Additional optional components may be present, examples are syrup, nuts, chocolate pieces and fruit pieces.

The amount of water ice solution picked up after immersion is determined by the temperature of the ice confection core, while the ice crystal size is determined predominantly by the temperature of the hardening step. Thus, if the core was at  $-15^{\circ}\text{C}$  prior to immersion and the hardening step (iii) was obtained by immersion in liquid nitrogen then the water ice will have the desirable size of ice crystals but only a thin layer will be present. Hardening the product at  $-15^{\circ}\text{C}$  provides a thin layer with relatively large crystals. Similarly, a core cooled in liquid nitrogen but hardened at  $-15^{\circ}\text{C}$  will give relatively large amount of pick-up but a water ice with relatively large crystals.

The water ice component may contain low amounts of a fat containing material, e.g. milk, provided its presence does not interfere with the water crystallisation. The water ice maybe aerated.

The preferred average ice crystal size  $D_{(3,0)}$  of 80 micron is

generally obtained by using liquid nitrogen or other cryogenic liquid for both steps (i) and (iii). Using temperatures of about  $-40^{\circ}\text{C}$ , provided for example by a blast freezer tunnel, in both steps (i) and (iii) provides  
5 a water ice layer with ice crystals having a  $D_{(3,0)}$  of below 100 microns.

Consumer tests have shown the presence of water ice crystals below about 80 microns provide a particularly soft  
10 texture.

The method of the invention uses process steps which are easy to operate sequentially and uses apparatus and cooling materials which are either in wide use or are available  
15 commercially and are easily handled.

The surface of the milk containing ice confection is preferably brought to the desired low temperature by immersing it in liquid nitrogen or other liquified gas at  
20 low temperature, or contacting the desired surface with a heat exchanging surface cooled to an appropriate low temperature, for example with an innocuous liquid refrigerant such as liquid nitrogen or a solid refrigerant such as carbon dioxide.

25 In another method successive layers of water ice can be laid down on the surface of the mass of milk containing ice confection by immersing the mass in water ice solution and then in a suitable cryogenic liquid or in a refrigerated  
30 volume at low temperature to make another layer of water ice. These stages can be repeated to build up a thicker layer of water ice.

The preferred viscosity of the water ice solution is up to  
35 5 poise to provide optimum generation of the water ice layer. A 0.2% w/w aqueous solution of locust bean gum (LBG) has a viscosity of about 1 poise.

It is not necessary for the second cooling stage to be at the same temperature as the stage cooling the core. Thus, dependent on the apparatus available and desired product properties, it may be at a higher or lower temperature.

5

The ice confection core can be subjected to a moulding stage prior to immersion in the water ice solution. With suitable design and thickness of water ice layer the final product will exhibit the moulding. The ice confection may contain fruit pieces, nuts and syrup, as examples of other optional components. Usually the confection will include a stick penetrating the core to allow it to be held in the hand.

10

The relatively small ice crystal size and orientation of the water ice and selection of the total solids provides a soft texture to the water ice when bitten. The texture of the milk protein containing ice confection is also very good because it is formed as the core by standard processing steps. There is no restriction or overrun which will usually be in the range from about 50% to about 150%. Additionally, the use of standard processes allows the usual components, e.g. fats to be present at the usual levels. Thus there is no restriction on the ice confection caused by viscosity requirements to allow feed into a quiescently formed water ice shell. A product formed by the quiescent process will have larger ice crystals, for example some in the order of millimetres. In general quiescently frozen products have dendritic ice crystals, while those produced according to the present invention have a more rounded shape comparable to those obtained in a freezer barrel. A complete quiescently formed split was found to be harder to bite, crunchier and less chewy. The water ice layer was less adhesive to the core.

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A solids level of below about 15% in the water ice will give only a small amount of structuring and flavour while

about 50% the solids content provide a very soft water ice layer.

Slushes, i.e. water ice solutions containing ice crystals, are usable in the invention to provide a roughened water ice layer. These ice crystals may include a gas clathrate, for example as described in EP 0201143. The ice crystals formed by the process of the present invention provide a soft texture.

#### Test methods

Ice crystal size: a thin water ice sample was examined using a cold stage (-20°C) microscope in a white spirit matrix. Polarising filters were used at x100 magnification to obtain maximum contrast and a Zeiss particle size analyzer used to obtain the average ice crystal size as  $D_{(3,0)}$ .

#### SPECIFIC DESCRIPTION OF THE INVENTION

Examples of the invention will now be given to illustrate but not limit the invention.

##### Example I

An ice cream formulation with the following composition was prepared using standard techniques.



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	<u>Ingredient</u>	<u>Weight %</u>
	skimmed milk powder	10.0
	sugars	17.2
5	butter	10.5
	flavour	0.1
	water	61.5
	emulsifier	0.4
	stabiliser	0.25

10

The ice cream was prepared with an overrun of 100%, extruded through a shaped nozzle to give a cylinder of 56g and the stick inserted. It was then hardened in a freezing tunnel at -40°C. After leaving the tunnel the portions were dipped in liquid nitrogen for 8 seconds and then in a water ice solution at 5°C, which is the usual temperature of storage, for 15 seconds. This solution had a composition of:

20	<u>Ingredient</u>	<u>Weight %</u>
	sugars	21.5
	stabiliser (LBG)	0.4
	fruit solids	4.4
25	citric acid	0.2
	colour	0.2
	water	remainder

30 The excess water ice solution was allowed to drip off and then the portions were immersed in liquid nitrogen to harden the external surface and complete the formation of the water ice layer. The product contained 25g water ice in the external layer.

35 The products were then stored at about -30°C in a cold store before distribution. The particle size distribution ( $D_{(3,0)}$ ) in the water ice layer immediately after preparation

was about 55 micron; this increased to about 75 microns on storage during distribution.

#### Example II

5 Samples of the ice cream core prepared as in Example I were cooled to temperatures of -15°C, -25°C, -30°C and -40°C in a refrigerated volume. They were then immersed in the Example I water ice solution for 10 seconds and the products hardened at the above temperatures.

10 The results are shown in Table I with the Example I results included for comparison. It is seen the amount of water ice reduces as the core temperature rises. Increased amounts of water ice can be picked up by using more cycles of cooling/immersion.

Table I

20	Temperature of core °C	Hardening Temp °C	Weight of water ice (g)
	Liq N <sub>2</sub> *	Liq N <sub>2</sub> *	25
	-40	-40	18 (A)
25	-30	-30	14
	-25	-25	13
	-15	-15	8 (B)

\* 8 seconds exposure

30 The products (A) using -40°C for the core temperature and hardening stage had a  $D_{(3,0)}$  of 85 microns, while the products (B) using -15°C for the core temperature and hardening stage had a  $D_{(3,0)}$  of above 200 microns.

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CLAIMS

- 5 1. A method of preparing a two-component ice confection in which:
- i) a surface of a mass of milk containing ice confection is brought to a temperature of below about  $-15^{\circ}\text{C}$ ,
- 10 ii) the surface is contacted with a water ice solution having a solids content between about 15% and about 50% by weight for a time sufficient to allow a layer of water ice to form on the surface, and
- 15 iii) the whole is subjected to a hardening step to form the water ice layer.
2. A method according to claim 1 wherein the temperature of the surface is below about  $-25^{\circ}\text{C}$ .
- 20 3. A method according to claim 2 wherein the temperature is below about  $-40^{\circ}\text{C}$ .
- 25 4. A method according to any preceding claim in which the cycle of cooling/immersion is repeated to build up successive layers of water ice.
- 30 5. A method according to any preceding claim wherein cooling is obtained by immersion in a cryogenic liquid.
6. A two component ice confection obtainable by the method of any preceding claim.
- 35 7. A two component ice confection comprising a mass of milk containing ice confection having a water ice on at least one surface having an average ice crystal size ( $D_{(3,0^{\circ})}$ ) below 100 micron, preferably below 80 micron.

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8. A two component confection according to claim 6 or 7 having a stick penetrating the core to provide hand holding.

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## INTERNATIONAL SEARCH REPORT

Application No

PCT/EP 95/00384

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A23G9/02 A23G9/24 A23G9/26

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 548 045 (R. A. ALTARES ET AL.) 22 October 1985 see column 3, line 4 - column 4, line 21; claim 1 ---	1-3,5-8
X	EP,A,0 500 940 (H. TOMIOKA ET AL.) 2 September 1992 see page 3, line 6 - line 27; figures 1-4,10,15; examples 1-3 ---	1-6,8
X	US,A,2 360 559 (D. GLAZER) 17 October 1944 see page 2, column 1, line 22 - line 74; figures; examples -----	1,6,8

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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